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City of Columbus Electric Vehicle Fleet Adoption Analysis

Ian Newman, Megan Gilroy, Drew Bessignano, Emily Jones, Melissa Wilkinson; SMART Columbus

INTRODUCTION

The city of Columbus became the sole winner of the U.S. Department of Transportation's (USDOT) first Smart City Challenge in 2016. Columbus was awarded $50 million in funding to embrace progress in the transportation sector. To reinvent mobility, Smart Columbus decided to add a total of 200 electric vehicles (EVs) into their police and fire fleets by 2020. The electric models will replace conventional gas burning vehicles currently driven by Columbus Fire and Police units.

SCOPE

Goal: Uncover the value and savings of the changing city fleet and produce comprehensive recommendations for the future of the fleet.

How did we accomplish this?

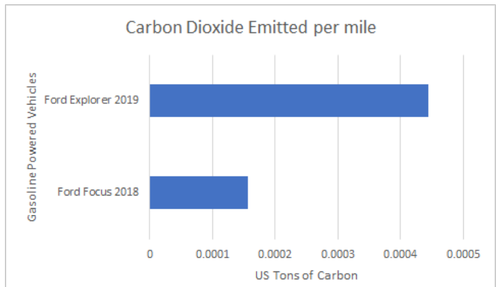
- Conduct a Net Present Value analysis on the incorporation of the new Leaf, Fusion Energi, and Bolt models EVs.
- Research of current and future EVs.
- Investigate case studies from Atlanta and Philadelphia to compare Columbus's fleet and goals to other cities.
- Evaluate CO2 emissions savings from the city switching their vehicles to EVs.

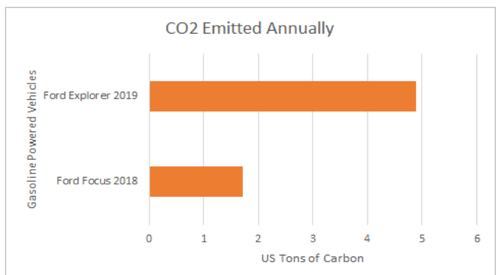
Figure 1A & 1B: 2019 Ford Explorer and 2019 Nissan LEAF Comparison

RESEARCH METHODS

- Communication with the city of Columbus via email; they shared information on their electric vehicle fleet gathered prior to this project.
- Read case studies from other cities (specifically Philadelphia and Atlanta) from their city sustainability websites.
- Speaking directly with experts at local dealerships.
- Reading automotive company sustainability reports.
- Mathematical calculations for our NPV analysis.

CO2 Emission Reductions



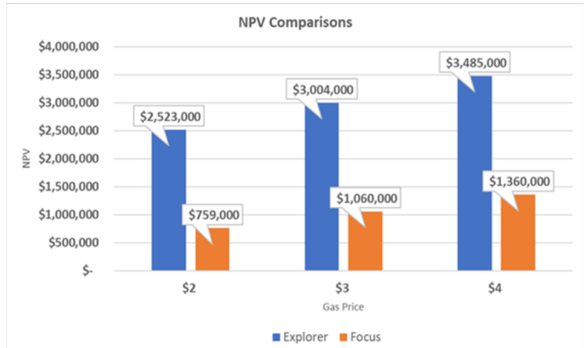


EV Fleet Comparisons

Columbus
6,200-vehicle fleet
93 fully electric or electric hybrid
Additional 107 EVs added by 2020
Philadelphia
6,000-vehicle fleet
21 electric hybrid vehicles
Additional 20 EVs added by 2020
Atlanta
1,500-vehicle fleet
50 fully electric or electric hybrid
Reduce carbon emissions 20% by 2020

RESULTS[4 - 12]

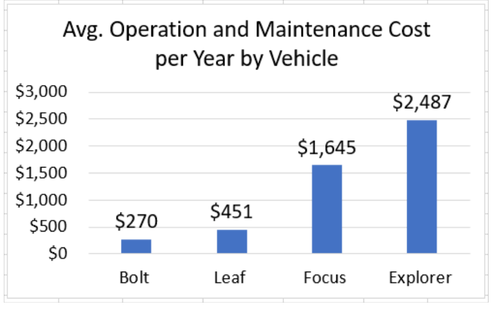
The graph below illustrates a NPV comparison between two gasoline-powered vehicles, the Ford Explorer and the Ford Focus, at three different gas prices. The Explorer retains a much higher NPV in all three price circumstances.



The following table shows the calculations used to determine the NPV for the Ford Explorer at different gas prices.

2018*-2028 Net Present Value - Total			
Discount rate = 3%			
Electricity Rate	$ 0.07		
Price of 97 EV's purchased by City of Columbus	$ 1,875,000		
Price of 97 Ford Explorers	$ 3,165,595		
Cost of Electric Vehicle (Fuel and Maintenance)	$ 19,633		
Gas Price	$ 2.00	$ 3.00	$ 4.00
Cost of Gas Vehicle (Fuel and Maintenance)	$ 73,137	$ 73,719	$ 74,300
Net Present Value	**2,523,652**	**3,004,803**	**3,485,953**

The graph below shows the average operation and maintenance costs of each vehicle.



CONCLUSIONS & RECOMMENDATIONS

The conclusions arrived from this research are as follows,

- Switch from conventional vehicles to EVs → environmentally and monetarily beneficial.
- Maintains status as a leader in sustainable vehicle fleets among comparable cities.
- From the NPV analysis → EVs are substantially less expensive than Ford Explorers.
- Columbus will experience larger returns with higher gas prices.
- With the passing of the 2019 Ohio Gas Tax → Columbus will experience higher returns on EVs.

Our recommendations are as follows,

- **Next Year:** Continuation of implementation of small EVs for small conventional vehicles.
- **Next Five Years:** Replacing large vehicles with electric trucks that should be available to consumers in the near future.
- **Next Ten Years:** Continue momentum with goal of a 100% EV fleet.

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THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

SMART COLUMBUS

Ian Newman / newman.580@osu.edu / (440) 785-5616
Megan Gilroy / gilroy.26@osu.edu / (330) 459-6928
Emily Jones / jones.6503@osu.edu / (740) 500-9523
Drew Bessignano / bessignano.3@osu.edu / (614) 561-2958
Melissa Wilkinson / Wilkinson.244@osu.edu/ (330) 931-7701